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EXAMINER

CLARK, MAXWELL A

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/821,123	<b>Applicant(s)</b> LITTLE ET AL.	
	<b>Examiner</b> MAXWELL A. CLARK	<b>Art Unit</b> 2416	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 14 July 2008.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-34 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-34 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>11/05; 2/08</u>   | 6) <input type="checkbox"/> Other: _____                          |

**DETAILED ACTION**

***Response to Arguments***

1. Applicants' arguments filed on the 14th of July, 2008 with respect to the abstract have been fully considered but they are not persuasive.
2. Applicants' arguments with respect to the claim objections and drawing objections have been fully considered and are persuasive. The objections of claims 2-4, 19-21 and 25-27, and the objections of the drawings have been withdrawn.
3. Applicants' arguments with respect to the Rejections under 35 U.S.C. § 112 have been fully considered:
  - a. Regarding claims 2-5 rejected under 35 U.S.C. § 112, first paragraph, applicant believes that one skilled in the art would recognize that given a variable "M", the "M/2" is one half of M. Furthermore, Applicant asserts that the specification's discussion of 2:1 multiplexors and 4:1 multiplexors appearing paragraphs [0021], [0030], is sufficient to clearly convey to one of ordinary skill in the art the invention that is claimed. However, the specification's discussions of 2:1 multiplexors and 4:1 multiplexors suggest a "N/2 to M", i.e. (4/2):1 or 2:1 multiplexer, which is different from a "N to M/2" multiplexor and is not disclosed in the specification. N to M multiplexing is clearly described throughout the application without mention, description, obviousness or inherency of N to M/2 multiplexing. Therefore, Applicants' arguments are not persuasive.
  - b. Regarding claims 15-16, 19-20, 22, 24 and 31 rejected under 35 U.S.C. § 112, second paragraph, Applicants' arguments are persuasive and the objections have been withdrawn.

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4. Applicants' arguments with respect to claim rejections under 35 U.S.C. § 102 and 35 U.S.C. § 103 of claims 1-24 have been considered but are moot in view of the new ground(s) of rejection.

5. Applicants' arguments with respect to the claim rejections under 35 U.S.C. § 102 and 35 U.S.C. § 103 of claims 25-34 have been fully considered but they are not persuasive.

c. Regarding claim 25, applicant argues that "the multiplexor of Knell is a derotation multiplexor that is used to handle a linear or curved transducer" and "Nothing is stated that the multiplexor needs to reduce the channels to address the linear or curved transducer." Applicants' arguments are not persuasive, examiner respectively asserts that was well known in the art at the time of the instant application that a de-rotation multiplexor will decrease the number of the information channels from the transducer elements and the beam former inputs, i.e. multiplexing them. Examiner points to support reference "Laparoscopic Ultrasound for Minimally Invasive Surgery", D.R. Dietz, 1578 – 1995 IEEE Ultrasonics Symposium, wherein using a derotation multiplexer enables receive focus circuitry to use the same focus program for every ultrasound line minimizing the data transfer between lines and allowing the number of focusing channels to be reduced from 48 to 24 by taking advantage of aperture symmetry. The support reference is used solely for support that it was well known in the art at the time on the instant application that multiplexing is used to reduce information channels, i.e. the support is added only as directly corresponding evidence to support the prior common knowledge finding, and it does not result in a new issue or constitute a new ground of rejection.

d. Regarding claim 29, Applicants' argue that Knell does not disclose a cross-point switch. Examiner points to applicants' specification, ¶0007, wherein a cross-point switch is disclosed as a summer, "an ASIC in communication with the data path between the transducer and the beam former, including circuitry operable as a bank of multiplexors or as a summer/cross-point switch." Examiner clearly points out that Knell discloses summer/cross-point switch in the rejection. Furthermore, Applicants' argue that "Examiner in rejection claim 30 states that Knell does not disclose a cross-point switch." To the contrary, Examiner states "Knell does not expressly disclose cross-point circuitry," i.e. circuitry to control the cross-point switch, which is different from cross point circuitry.

e. Regarding claims 26-28 and 30-34, Applicants' arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references.

### ***Specification***

Applicants' are reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means"

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and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

The purpose of the abstract is to enable the United States Patent and Trademark Office and the public generally to determine quickly from a cursory inspection the nature and gist of the technical disclosure, regardless of his or her degree of familiarity with patent documents, and should include that which is new in the art to which the invention pertains.

***Claim Rejections - 35 USC § 112***

6. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 2-5 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Regarding the N to M/2 signal multiplexing found in line 5 of claim 2, N to M/2 multiplexing is not described in the application as filed. N to M multiplexing is clearly described throughout the application without mention, description, obviousness or inherency of N to M/2 multiplexing.

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-24 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claims 1, 10, 12 and 13, the phrase "adapted for" renders the claim indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention. See MPEP § 2111.04.

***Claim Rejections - 35 USC § 102***

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3, 10-14 and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Snyder (US 5,520,187).

Regarding claim 1, Snyder discloses an application specific integrated circuit (ASIC) (abstract, a programmable probe multiplexer) adapted for use in a plurality of systems (abstract, can be reconfigured for use with multiple imaging systems), wherein the system is one of the plurality of systems, and each system has a circuit configuration that uses a different number of signal channels (col. 2, lines -52, a programmable multiplexer for reconfiguring the transducer probe for use with multiple imaging systems having different channel counts, i.e. signal channels) for further processing by said application specific integrated circuit (col. 5, lines 47-50, the system loads the probe multiplexer through a serial data communications link (shown as a

conventional JTAG interface in FIG. 4) and then begins normal imaging operations, i.e. further processing by said application specific integrated circuit).

Regarding claim 2, Snyder discloses a plurality of multiplexors providing N to M signal multiplexing (fig. 2-44), wherein in a first configuration of said circuit configurations said ASIC is configured to provide N to M signal multiplexing (fig. 3-44, col. 4, lines 32-34, the switches 58 are connected to the system channel bus and the transducer elements in a 2:1 multiplexer configuration), and wherein in a second configuration of said circuit configuration said ASIC is configured to provide N to M/2 signal multiplexing (fig. 3, col. 4, lines 66-67 through col. 5, line 1, the analog switch depicted in FIG. 3 is actually eight analog single-pole single-throw switches, configured to form four 2:1 multiplexers).

Regarding claim 3, Snyder discloses N signal inputs, M signal outputs, at least one select signal input, and at least one enable signal input, said enable signal input being utilized in providing said N to M/2 signal multiplexing of said second configuration (fig. 3, col. 4, lines 66-67 through col. 5, line 1, the analog switch depicted in FIG. 3 is actually eight analog single-pole single-throw switches, configured to form four 2:1 multiplexers).

Regarding claim 10, Snyder discloses an application specific integrated circuit (ASIC) (abstract, a programmable probe multiplexer) adapted for use in a plurality of circuit configurations, said circuit configurations providing for different numbers of signal channels (col. 2, lines -52, a programmable multiplexer for reconfiguring the transducer probe for use with multiple imaging systems having different channel counts, i.e. signal channels) for further processing using same circuitry of said application specific integrated circuit (shown as a conventional JTAG interface in FIG. 4) and then begins normal imaging operations, i.e. further



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processing by said application specific integrated circuit); wherein the ASIC is included in an application comprising a transducer (col. 3, lines 28-30, fig. 1, a transducer multiplexer control program is stored in the master controller 12 which receives probe ID signals from the transducer probe assembly via a transducer interface), a beam former (col. 3, line 38, fig. 1), and a data path (col. 3, line 38, fig. 1, connector), and wherein the data path is in communication with the ASIC, the transducer, and the beam former (col. 3, line 37-39, fig. 1, the transducer element array is thus multiplexed from the transducer connector to the beam former under the control of the master controller).

Regarding claim 11, Snyder discloses a signal processing unit external to the data path and in communication with the data path at a number of points thereon and is operable to capture and insert information in the data path at each of those number of points (fig. 1, col. 1, lines 56-58, processors 4 (including a separate processor for each different mode), a scan converter/display controller 6 and a kernel 8; col. 2, line 3-4, processors 4 and scan converter 6 wherein the scan control sequencer 16 is programmed by the host with the vector sequences and synchronization options for acoustic frame acquisitions; col. 2, lines 11-14, data is input to a processor 4, where it is processed according to the acquisition mode and output as processed vector (beam) data to the scan converter/display processor 6).

Regarding claim 12, Snyder discloses, determining a number of channels for use in a data path (col. 2, line 62-65, the multiplexer hardware adjusts the program or channel map to reconfigure the probe to accommodate the system); and configuring an ASIC adapted for use in a plurality of systems (col. 2, lines 50-52, a programmable multiplexer, i.e. ASIC, for reconfiguring the transducer probe for use with multiple imaging systems, i.e. a plurality of

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systems) wherein each system has a circuit configuration that uses a different number of channels, to provide said determined number of channels (col. 2, lines 50-53, a programmable multiplexer, i.e. ASIC, for reconfiguring the transducer probe for use with multiple imaging systems, i.e. a plurality of systems, having different channel counts, i.e. a different number of channels, to provide said determined number of channels).

Regarding claim 13, Snyder discloses determining a number of channels for use in a data path (col. 2, line 62-65, the multiplexer hardware adjusts the program or channel map to reconfigure the probe to accommodate the system); configuring an ASIC adapted for use in a plurality of configurations to provide said determined number of channels (col. 2, lines -52, a programmable multiplexer for reconfiguring the transducer probe for use with multiple imaging systems having different channel counts); and implementing in a sonogram imaging system the ASIC (col. 3, lines 11-12, fig. 1, a block diagram of an ultrasound imaging system), a first beam former a beam former (col. 3, line 38, fig. 1), the data path (col. 3, line 38, fig. 1, connector), and a transducer array, wherein the ASIC, the first beam former, and the transducer array are in communication with the data path (col. 3, line 37-39, fig. 1, the transducer element array is thus multiplexed from the transducer connector to the beam former under the control of the master controller).

Regarding claim 14, Snyder discloses summing data on each of at least two channels by the ASIC. (col. 2, lines 9-10, the two summed digital baseband I,Q receive beams).

Regarding claim 24, Snyder discloses a signal processing unit to communicate with the data path at a number of points; programming the signal processing unit with code to provide a mode of functionality not originally included in a platform using the method; and operating the

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signal processing unit to intercept and insert data along the number of points on the path, thereby instructing the platform to perform the mode (fig. 1, col. 1, lines 56-58, processors 4 (including a separate processor for each different mode), a scan converter/display controller 6 and a kernel 8; col. 2, line 3-4, processors 4 and scan converter 6 wherein the scan control sequencer 16 is programmed by the host with the vector sequences and synchronization options for acoustic frame acquisitions; col. 2, lines 11-14, data is input to a processor 4, where it is processed according to the acquisition mode and output as processed vector (beam) data to the scan converter/display processor 6).

Claims 25-29 and 32-3 are rejected under 35 U.S.C. 102(b) as being anticipated by Knell et al. (US 6,468,213 B1).

Regarding claim 25, Knell discloses a sonogram imaging system (Title, wherein the ultrasound system corresponds to the sonogram imaging system) including a transducer (col. 18, line 43); a beam former (col. 18, line 45); a data path including a plurality of information channels connecting the transducer to the beam former (col. 18, lines 63-67 wherein the signal processing path, including signals prior to beam- summing corresponds to a data path including a plurality of information channels connecting the transducer to the beam former); and an ASIC in communication with the data path between the transducer and the beam former, including circuitry operable as a bank of multiplexers to decrease a number of the information channels from the transducer to the beam former (col. 18, lines 26-45, wherein the system, i.e. ASIC, includes de-rotation multiplexer between the transducer elements and the beam former inputs, examiner takes official notice that multiplexing the transducer elements between the transducer

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elements and the beam former inputs will decrease the number of the information channels from the transducer elements and the beam former inputs; col. 13, lines 25-32 and lines 42-45).

Regarding claim 26, Knell discloses the circuitry of an ASIC comprising a plurality of 2:1 multiplexers, wherein each multiplexer includes an enable switch and a select switch (fig. 12p, element 1242; col. 15, lines 6-19, wherein multiplexers 1242 and 1243 together with A and B inputs muxed via the multiplexer corresponds to the plurality of 2:1 multiplexers with the multiplexer controlled by control 1245, additionally, multiplexers inherently includes an enable and select switch).

Regarding claim 27, the ASIC of claim 26 is controlled via the beam former control since the ASIC is part of the beam former controller (col. 3, lines 37-38, wherein the beam former controller 12 comprises an ASIC; fig. 12p, element 1242; col. 15, lines 6-19, wherein multiplexers 1242 and 1243 together with A and B inputs muxed by the multiplexer correspond to the plurality of 2:1 multiplexers with the multiplexer controlled by control 1245, hence, providing higher order multiplexing functionality, additionally, multiplexers inherently includes an enable and select switch ).

Regarding claim 28, Knell discloses a digital serial control bus to connect the enable and select switches to the beam former (col. 11, lines 50-51, wherein the data samples may be digital data samples from the beam former, in the case of digital data samples, examiner takes official notice the control bus to connect the enable and select switches to the beam former are digital since the invention includes digital circuits, hence digital controls).

Regarding claim 29, Knell discloses a sonogram imaging system (col. 11, line 46, wherein the ultrasound system corresponds to the sonogram imaging system) including a

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transducer (col. 11, line 47); a beam former (col. 11, line 46); a data path including a plurality of information channels connecting the transducer to the beam former (col. 11, line 45-55, wherein the receive signals from the N transducer elements labeled EL0, EL1 ... ELN correspond to the plurality of information channels connecting the transducer to the beam former); and an ASIC in communication with the data path between the transducer and the beam former, including circuitry operable as a summer/cross-point switch, to route a number of information channels from the transducer to the beam former (figs. 12E-12L; col. 2, line 47; col. 12, line 18 wherein the routing of a number of information channels from the transducer to the beam former corresponds to the receive processing path; col. 18, lines 31-35, wherein the summers described as application specific integrated circuits (ASICs)).

Regarding claim 32, Knell discloses circuitry included by the ASIC controlled by the beam former via a bus (col. 4, lines 21-29, wherein the beam former comprises an ASIC, hence the ASIC is controlled via the beam former, it is inherent that the control of the ASIC by the beam former is done via communication bus).

Regarding claim 33, Knell discloses a beam former which sends instructions to logic included in the ASIC (col. 3, lines 36-57, wherein the beam former controller comprises an ASIC for control, hence the beam former sends instruction to the logic included in the ASIC; col. 4, lines 21-29, wherein the beam former controller comprises an ASIC for control, hence the beam former sends instruction to the logic included in the ASIC wherein the beam former sums the signals from the transducer elements, i.e. instructions to process data as a summer).

***Claim Rejections - 35 USC § 103***

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 4-9 and 15-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Snyder (US 5,520,187) in view of Agelsen et al. (US 2005/023402 A1).

Snyder discloses the claimed limitations in paragraph 8 above. Snyder does not expressly disclose the following features: regarding claim 4, wherein said plurality of multiplexors are divided into hardwired pairs, and only one of each pair is enabled during a receive operation; regarding claim 5, wherein at least one of said select signal input and said enable signal input comprise a digital serial control bus; regarding claim 6 wherein said ASIC comprises: a circuit configurable to provide a cross point switch function in a first configuration of said circuit configurations and to provide a signal summer function in a second configuration of said circuit configurations; regarding claim 7, wherein said cross-point switch function comprises selectively routing signal channels to one or more beam formers; regarding claim 8, wherein the signal

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summer function comprises a symmetric signal summing operation; regarding claim 9, wherein the symmetric signal summing operation comprises summing one or more signals that are determined to be of similar weight and delay; regarding claim 15, wherein summing data comprises: receiving signals from a control circuit instructing that certain of the channels are to be divided into symmetric pairs and those pairs added, thereby decreasing the number of output channels; and routing the added pairs to one or more beam formers; regarding claim 16, wherein summing data comprises: receiving signals from a control circuit instructing that certain of the channels are to be divided into adjacent pairs and those pairs added, thereby decreasing the number of output channels; and routing the added pairs to one or more beam formers; regarding claim 17, operating circuitry on the ASIC as a cross-point switch to increase the number of channels from the ASIC to one or more beam formers; regarding claim 18, wherein operating as a cross-point switch comprises receiving signals from a control circuit instructing that certain of the channels be routed to one or more of the beam formers; regarding claim 19, operating circuitry on the ASIC as a plurality of multiplexors, thereby decreasing the number of channels from a transducer array to a beam former; regarding claim 20, wherein the multiplexors are 2:1 multiplexors, and wherein operating as a plurality of multiplexors comprises selectively enabling one of every two 2:1 multiplexors, thereby providing 4:1 multiplexing functionality; regarding claim 21, wherein selectively enabling comprises stimulating an enable switch on one of every two 2:1 multiplexors by a control signal from a beam former;

Agelsen discloses a digital ultrasound beam former for ultrasound imaging among devices comprising the following features.

Regarding claim 4, Agelsen discloses a plurality of multiplexers divided into hardwired pairs, and only one of each pair is enabled during a receive operation (§0025, the array coupling means 102 connects selected elements to selected sets of J T/R circuits, where the minimum value of J is one as illustrated in FIG. 1a; §0026, the array coupling means 102 can contain flexible multiplexers that are set up by the control processor 111 over the bus 110, so that one can have selectable element to T/R circuit connections for one particular transducer array).

Regarding claim 5, Angelsen discloses select signal input and said enable signal input comprise a digital serial control bus (see in particular paragraph [0024], wherein the digital serial control bus corresponds to bus 110).

Regarding claim 6, Angelsen discloses a circuit configurable to provide a cross point switch function in a first configuration of said circuit configurations and to provide a signal summer function in a second configuration of said circuit configurations (§0030, the array coupling means 102 is in this example a multiplexer or cross-point switch that connects symmetric pairs of elements to the T/R circuits that are connected to the same ADC multiplexer, as illustrated in FIG. 2d wherein the multiplexers 112 are in this example designed together with the receiver amplifier outputs so that their output produces the sum of the (current sum or voltage sum) pair element signals as inputs to the ADCs 113 that provides the digitized sum signal to the digital beam forming circuits 114, where the signals are appropriately delayed, amplitude scaled and summed to form a dynamically focused beam with beam central axis 223 normal to the array surface).

Regarding claim 7, Angelsen discloses the cross-point switch function comprises selectively routing signal channels to one or more beam formers (§0030, the signals from the



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paired elements around the beam axis, can be summed before the T/R circuits by multiplexers in the array coupling means, and the T/R circuits, multiplexers, ADCs, and beam forming circuits operating as each sum of symmetric element signals was a single signal).

Regarding claim 8, Angelsen discloses the signal summer function comprises a symmetric signal summing operation (¶0030, the signals from the paired elements around the beam axis, can be summed before the T/R circuits by multiplexers in the array coupling means, and the T/R circuits, multiplexers, ADCs, and beam forming circuits operating as each sum of symmetric element signals was a single signal).

Regarding claim 9, Angelsen discloses the symmetric signal summing operation comprises summing one or more signals that are determined to be of similar weight and delay (¶0025, The multiplexers 112 are in this example designed together with the receiver amplifier outputs so that their output produces the sum of the (current sum or voltage sum) pair element signals as inputs to the ADCs 113 that provides the digitized sum signal to the digital beam forming circuits 114, where the signals are appropriately delayed, amplitude scaled and summed to form a dynamically focused beam with beam central axis 223 normal to the array surface).

Regarding claim 15, Angelsen discloses receiving signals from a control circuit instructing that certain of the channels are to be divided into symmetric pairs and those pairs added, thereby decreasing the number of output channels; and routing the added pairs to one or more beam formers (¶0030, the signals from the paired elements around the beam axis, can be summed before the T/R circuits by multiplexers in the array coupling means, and the T/R circuits, multiplexers, ADCs, and beam forming circuits operating as each sum of symmetric element signals was a single signal; ¶0036, wherein the array coupling means is for this

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operation multiplexers that connects the array elements to the appropriate T/R circuits to obtain the same delay for pairs of array elements that are symmetric around the aperture center corresponds to certain channels divided into symmetric pairs, wherein the pairs added corresponds to multiplexing the pairs, hence decreasing the number of output channels).

Regarding claim 16, Angelsen discloses receiving signals from a control circuit instructing that certain of the channels should be divided into adjacent pairs and those pairs added, thereby decreasing the number of output channels; and routing the added pairs to one or more beam formers (paragraph [0038], wherein the array coupling means is configured so that the multiplexers only use the upper T/R circuits, i.e. they will be adjacent pairs).

Regarding claim 17, Angelsen discloses a cross-point switch to increase the number of channels from the ASIC to one or more beam formers (§0030, the signals from the paired elements around the beam axis, can be summed before the T/R circuits by multiplexers in the array coupling means, and the T/R circuits, multiplexers, ADCs, and beam forming circuits operating as each sum of symmetric element signals was a single signal).

Regarding claim 18, Angelsen discloses the cross-point switch comprising of receiving signals from a control circuit (paragraph [0031], wherein the control circuit corresponds to the control processor 111 ) instructing that certain of the channels be routed to one or more of the beam formers (see in particular paragraph [0030], wherein the T/R circuits transmit the information from said channels to the beam forming circuits corresponds to the channels being routed to one or more of the beam formers).

Regarding claim 19, Angelsen discloses a plurality of multiplexors decreasing the number of channels from a transducer array to a beam former (§0030, the signals from the paired

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elements around the beam axis, can be summed before the T/R circuits by multiplexers in the array coupling means, and the T/R circuits, multiplexers, ADCs, and beam forming circuits operating as each sum of symmetric element signals was a single signal).

Regarding claim 20, Angelsen discloses 2:1 multiplexers (see in particular paragraph [0027], wherein the multiplexers muxing channels A and B correspond to a 2:1 multiplexers), and wherein operating as a plurality of multiplexers comprises selectively enabling one of every two 2:1 multiplexers (see in particular paragraph [0026] wherein the multiplexers are described as flexible, i.e. configurable, so that one can have selectable element connection for one particular transducer array, i.e. coupling 2:1 multiplexers providing additional inputs), thereby providing 4:1 multiplexing functionality (additionally see paragraph [0035], wherein the 4 to 1 multiplexers have inputs configurable to enables any one to 4 of the inputs).

Regarding claim 21, Angelsen discloses stimulating an enable switch on one of every two 2:1 multiplexers by a control signal from a beam former (paragraph [0036], wherein the beam former operates, i.e. controls, the switched array wherein the array being controlled comprises multiplexers that connect the array elements).

It would have been obvious to one of ordinary skill in the art at the time of the instant application to modify Snyder according to the features taught by Angelsen in order to provide digital beam forming that is done with field programmable digital circuits that provide reconfigurable front ends, see in particular paragraph 0013.

Claims 22-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Snyder (US 5,520,187) in view of Knell et al. (USPN 6,468,213 B1).

Snyder discloses the claimed limitations in paragraph 8 above. Snyder does not expressly disclose the following features: regarding claim 22, implementing two beam formers in communication with the data path; and operating the two beam formers and a transducer array to form multiple receive beams; regarding claim 23, operating the two beam formers and the transducer array perform a multi-line receive operation.

Knell discloses using re-programmable logic devices to perform essential functionality in a subsystem among devices comprising the following features.

Regarding claim 22, Knell discloses multiple beam formers in communication with the data path; and operating the multiple beam formers and a transducer array to form multiple receive beams (col. 35, lines 46-60, wherein the multiple parallel beams correspond to the multiple beam formers which ultimately control the ultra-sonic pulses to create beams by the transducer array) for the purpose of providing a system that has multiple imaging capabilities such as Color Velocity (encoding the velocity of targets in motion) and Color Power (encoding the power of targets in motion) imaging and Spectral Doppler (including both PW and CW modes).<sup>23</sup>. (Original) The method of claim 22 further comprising operating the two beam formers and the transducer array perform a multi-line receive operation.

Regarding claim 23, Knell discloses a multi-line receive operation (col. 9, line 50- 51, wherein the multi-line acquisition corresponds to the multi-line receive operation).

It would have been obvious to one of ordinary skill in the art at the time of the instant application to modify Snyder according to the features taught by Knell in order to enable the use of re-programmable logic devices to perform essential functionality in a subsystem that allows for efficient implementation of the functions, see in particular col. 9, lines 16-19.

Claims 30, 31 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Knell et al. (USPN 6,468,213 B1 ) in view of Kristoffersen (US 2005/0113698 A1).

Regarding claim 30, Knell discloses the ASIC comprising a summation bus (fig. 12A-12M, wherein the summation bus corresponds to the data path of the aggregated channels constructed from the summer; col. 12, lines 17-18, wherein the summation bus is positioned after the summer, i.e. the receive processing path corresponds to the summation bus; col. 18, lines 31-35, wherein the summers described as application specific integrated circuits (ASICs)).

Knell does not expressly disclose cross-point circuitry. However, Kristoffersen discloses cross-point circuitry for the purpose of controlling multiple channel signals for broadband beam forming (see in particular paragraph [0119]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Knell to include cross-point circuitry, since Knell discloses multiple channels as well as receiving data from multiple elements (col. 35, lines 47-60), for the purpose of controlling multiple channel signals for broadband beam forming in a multi- line ultrasound system.

Regarding claim 31, Knell discloses the ASIC comprising a summation bus (fig 12A-12M, wherein the summation bus corresponds to the data path of the aggregated channels constructed from the summer; col. 12, lines 17-18, wherein the summation bus is positioned after the summer, i.e. the receive processing path corresponds to the summation bus; col. 18, lines 31-35, wherein the summers described as application specific integrated circuits (ASICs); Illustrated in fig. 12A is the summation bus between the summation device 1203 and the smoothing filter 1204 wherein EL0 ... ELN are summed, hence the number of information channels between the transducer and the control circuit are decreased).

Regarding claim 34, Knell discloses a beam former which sends instructions to logic included in the ASIC (col. 3, lines 36-57, wherein the beam former controller comprises an ASIC for control, hence the beam former sends instruction to the logic included in the ASIC).

Knell does not expressly disclose cross-point the ASIC to process data as a cross-point switch. However, Kristoffersen discloses cross-point circuitry for the purpose of controlling multiple channel signals for broadband beam forming (see in particular paragraph [0119]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Knell to include cross-point processing included in the ASIC with instructions sent from the beam former, since Knell discloses multiple channels as well as receiving data from multiple elements (col. 35, lines 47-60), for the purpose of controlling multiple channel signals for broadband beam forming in a multi-line ultrasound system.

### ***Conclusion***

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

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12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Hwang; Juin-Jet et al. (US 6383139 B1), Little; Blake W. et al. (US 5893363 A1), Ogle; William R. et al. (US 5817024 A1) Bunce; Steven et al. (US 6203498 B1), Little; Blake W. et al. (US 20070071266 A1), Hwang, Juinjet (US 20050265267 A1), Henderson; Derek et al. (US 6695783 B2), Henderson, Derek et al. (US 20020082500 A1), Halmann, Menachem et al. (US 20050124890 A1), Tumer, Tumay O. et al. (US 20040239377 A1), Little; Blake et al. (US 7169108 B2), Tumer; Tumay O (US 6333648 B1), Berger, Noah et al. (US 20040015079 A1), Gilbert, Jeffrey M. et al. (US 20030176787 A1), Chiang; Alice M. et al. (US 6783493 B2), Knell; Christopher B. et al. (US 6468213 B1), Mehi; James et al. (US 20070239001 A1), Haugen, Geir Ultveit et al. (US 20050113699 A1), Savord; Bernard J. et al. (US 6126602 A1).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MAXWELL A. CLARK whose telephone number is (571) 270-1956. The examiner can normally be reached on Monday to Thursday 7:30A.M. through 5:00P.M. Eastern Standard Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Yao B. Kwang can be reached on (571) 272-3182. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

October 29, 2008

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